

## San Diego Integrated Regional Water Management Implementation Grant Proposal Economic Analysis – Flood Damage Reduction Costs and Benefits

Attachment 9 consists of the following items:

- ✓ **Flood Damage Reduction Costs and Benefits.** The body of this attachment provides an overview of the costs and benefits of this proposed funding package with respect to potential flood damage reduction.
- ✓ **Appendix 9-1.** Appendix 9-1 of this attachment contains information regarding the costs and flood damage reduction benefits of each individual project contained within this proposal.

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This attachment provides estimates for the flood damage reduction benefits for applicable projects. Only one project in this proposal, the *Chollas Creek Integration Project*, is projected to have flood damage reduction benefits.

Section 1 provides a summary of the regional flood control setting within the San Diego region.

Section 2 provides information regarding the costs of the *Chollas Creek Integration Project*, which is the only project in this proposal with flood damage reduction benefits.

Section 3 provides information regarding estimates for the costs and the flood damage reduction benefits of the *Chollas Creek Integration Project*. Where possible, each benefit was quantified and presented in physical or economic terms. In cases where quantitative analyses were not feasible, this attachment provides complimentary qualitative analyses. In addition, this attachment provides a description of economic factors that may affect or qualify the amount of economic benefits to be realized. This attachment also includes a discussion regarding uncertainties about the future that might affect the level of benefit received. Appendix 9-1 contains detailed information regarding the benefits anticipated to occur as a result of this proposal.

### 1. Regional Flood Control Background

The San Diego County Flood Control District (Flood Control District) is the primary flood control agency in the County. The Flood Control District (which is governed by the elected Supervisors of the County) establishes flood policies, maintains flood control facilities, operates a regional flood warning system, and is charged with protection of watercourses, watershed management, and protection of water quality. On a project-by-project basis, the Flood Control District coordinates flood control actions among the County's municipalities, federal and state agencies, watershed management groups, and flood control organizations in Orange and Riverside counties. Each municipality within the region is responsible for designing, constructing, and maintaining necessary flood control structures within its jurisdiction.

As described in Attachment 8, the San Diego County MS4 Permit (Order No. R9-2007-0001) regulates stormwater/urban runoff within the region. The County acts as Principal Copermittee for the 21 Copermittees. Each Copermittee is responsible for operating its own stormwater/urban runoff management program within its respective jurisdiction. As Principal Copermittee, the County coordinates the development and implementation of regional stormwater monitoring programs, regional education program, the standard urban stormwater mitigations plan criteria and requirements, and the hydromodification management plan. In this role, the County has organized the Stormwater Copermittee Management Committee to facilitate interaction and coordination among the Copermittees.

**Table 9-1: Flood Damage Reduction Costs and Benefits Summary**

#	Project	Project Sponsor	Total Present Value Project Costs	Total Present Value Flood Damage Reduction Benefits
1	Sustainable Landscapes Program	San Diego County Water Authority	\$1,157,709	\$0
2	North San Diego County Regional Recycled Water Project	Olivenhain Municipal Water District	\$17,199,249	\$0
3	North San Diego County Cooperative Demineralization Project	San Elijo Joint Powers Authority	\$27,802,301	\$0
4	Rural Disadvantaged Community (DAC) Partnership Project	Rural Community Assistance Corporation	\$707,463	\$0
5	Lake Hodges Water Quality and Quagga Mitigation Measures	San Diego County Water Authority	\$1,517,868	\$0
6	Implementing Nutrient Management in the Santa Margarita River Watershed	County of San Diego	\$1,534,082	\$0
7	Bannock Avenue Neighborhood Streetscape Enhancements for Tecolote Creek Watershed Protection	City of San Diego - Storm Water	\$4,168,512	\$0
8	Pilot Concrete Channel Infiltration Project	City of Santee	\$281,294	\$0
9	San Diego Regional Water Quality Assessment and Outreach Project	San Diego Coastkeeper	\$924,578	\$0
10	Chollas Creek Integration Project	Jacobs Center for Neighborhood Innovation	\$1,018,096	\$301,165
11	Regional Water Data Management Program	County of San Diego	\$540,043	\$0
	<b>TOTAL</b>		<b>\$56,851,195</b>	<b>\$301,165</b>

## 2. Total Project Costs of Proposed Projects

The following sections provide information about the total project costs associated with each proposed project within this *San Diego IRWM Implementation Grant Proposal*. The summary of total project costs is based on Table 17 in DWR's Implementation Grant Proposal Solicitation Package (DWR 2010), inclusive of the project budget information contained in Attachment 4. Appendix 9-1 contains the complete Table 17 export for the *Chollas Creek Integration Project*.

### *Project 10: Chollas Creek Integration Project*

The total estimated budget for the *Chollas Creek Integration Project* is \$994,500. Administration and maintenance costs are anticipated throughout the project lifetime, in order to maintain the riparian vegetation and remove trash from the restoration area. Operations and replacement costs are limited to irrigation components for the first three years until the planted vegetation matures. All additional costs total \$560,200 for the proposed project. This results in a total present value \$1,018,096 (in 2009 dollars).

Capital and implementation costs for the project will be expended from 2010 through 2013, with the largest capital cost in construction and implementation. The operation and maintenance costs are estimated to consist of administration, operation, maintenance, and replacement costs. Administration and maintenance costs will span from 2012 through 2060, whereas operation costs will span from 2012 to 2015 and replacement costs will be incurred from 2012 to 2014. Detailed cost information associated with the project, including present value calculations, are available in Appendix 9-1.

**Table 9-2: Total Project Costs**  
**Chollas Creek Integration Project**

Phase	Cost
<i>Chollas Creek Integration Project</i> Capital Costs	\$994,500
<i>Chollas Creek Integration Project</i> O&M Costs	\$560,200
<b>Total Project Costs</b>	<b>\$1,554,700</b>
<b>Total Present Value of Discounted Costs</b>	<b>\$1,018,096</b>

Note: Please see Appendix 9-1, Table 17 for additional detail on calculation of present value.

### 3. Flood Damage Reduction Benefits of Proposed Projects

The *Chollas Creek Integration Project* is the only project with expected flood damage reduction costs or benefits. There are no expected flood damage reduction costs or benefits associated with any other project in this proposal.

#### Project 10: Chollas Creek Integration Project

The benefits that are anticipated to result from implementation of the *Chollas Creek Integration Project* are summarized below in Table 9-3, and the cost-benefit overview is summarized in Table 9-4. This project would result in monetized benefits due to avoided flood damages. Detailed cost and benefit information associated with the project, including present value calculations, is provided in Appendix 9-1.

**Table 9-3: Benefits Summary**  
**Chollas Creek Integration Project**

Type of Benefit	Assessment Level	Beneficiaries
<b>Flood Damage Reduction Benefits</b>		
Avoided Flood Damages	Monetized	Local

**Table 9-4: Benefit-Cost Analysis Overview**  
**Chollas Creek Integration Project**

	Present Value (\$2009)
<b>Costs – Total Capital and O&amp;M</b>	\$1,018,096
<b>Monetizable Benefits</b>	
Avoided Flood Damages	\$301,165
<b>Qualitative Benefits</b>	<u><b>Qualitative Indicator*</b></u>
N/A	N/A

\*Magnitude of effect on net benefits

+/- (negligible or unknown); + (moderate positive); ++ (significant positive); - (moderate negative); -- (significant negative)

#### The “Without Project” Baseline

If the *Chollas Creek Integration Project* were not implemented, there would be no restoration of native floodplain habitat or associated flood hazard reductions within Chollas Creek. Additionally, without this project, an Opportunities Assessment would not be developed for Chollas Creek and associated benefits related to improving water quality, reducing flooding, and identifying land use opportunities for preserving open space and habitat would not be realized. Specifically, without the project, Chollas Creek Section 2A within the project area would continue to support disturbed riparian scrub habitat with many invasive plant species and be subject to dumping of trash and debris.

## Flood Damage Reduction Benefits

### Avoided Flood Damages

The *Chollas Creek Integration Project* would construct improvements to Chollas Creek to increase the capacity of the channel downstream of Euclid Avenue. Once channel grading and restoration has occurred, these improvements would reduce the frequency of flood flows reaching Euclid Avenue and therefore increase public health and safety conditions on this road. In addition, once channel grading and restoration has occurred, these improvements would reduce flooding depths and frequencies for properties immediately adjacent to the proposed restoration project, as well as for properties immediately upstream of the project area and adjacent to Euclid Avenue.

Although four of five existing residential structures would remain impacted, flood depths would be reduced by up to two feet for structures near Euclid Avenue during a 100-year storm event as a result of this project. In addition, the anticipated discharge over Euclid Avenue during a 50-year storm would be reduced by approximately 40% as a result of this project.

The Euclid Avenue culvert and Chollas Creek slope are anticipated to be damaged in increasing probabilities among the projected hydrologic events. Utilizing engineering reports and the Flood Rapid Assessment Model (FRAM), it was estimated that monetary benefits that would result from the aforementioned avoided flood damages would be \$301,165.

**Table 9-5: Avoided Flood Damages**  
***Chollas Creek Integration Project***

	Event Damage Without Project	Event Damage With Project	Total Avoided Costs
Avoided Flood Damages: 10-Year Hydrologic Event	\$53,634	\$32,180	\$21,454
Avoided Flood Damages: 15-Year Hydrologic Event	\$428,019	\$76,811	\$351,208
Avoided Flood Damages: 20-Year Hydrologic Event	\$1,156,038	\$1,053,623	\$102,415
Avoided Flood Damages: 25-Year Hydrologic Event	\$1,284,057	\$1,130,434	\$153,623
Avoided Flood Damages: 50-Year Hydrologic Event	\$2,036,340	\$1,821,804	\$214,536
<b>Total Avoided Flood Damage Reduction Costs</b>			<b>\$843,235</b>
<b>Total Avoided Flood Damage Reduction Costs after Discounting</b>			<b>\$301,165</b>

Sources: Rick Engineering December 21, 2010. Euclid Avenue Culvert Repair.

Rick Engineering. December 15, 2010. Chollas Creek Slope Repair.

Rick Engineering. December 21, 2010. Existing/Proposed Condition Structure Inundation.

### Distribution of Project Benefits and Identification of Beneficiaries

Table 9-6 summarizes the anticipated beneficiaries of flood damage reduction benefits that would be provided by the *Chollas Creek Integration Project*. The flood damage reduction benefits would benefit local residents within the floodplain adjacent to the project area.

**Table 9-6: Project Beneficiaries Summary**  
***Chollas Creek Integration Project***

Local	Regional	Statewide
Local residents within the floodplain	<i>Not Applicable</i>	<i>Not Applicable</i>

### Project Benefits Timeline Description

Flood reduction benefits would occur over a timeline relative to the probability of various hydrologic events. Therefore, this project would accrue benefits due to 10-year, 15-year, 20-year, 25-year, and 50-year flood events.

### Potential Adverse Effects from the Project

Any potential short-term impacts associated with this project will be addressed and mitigated during the CEQA compliance process. No long-term adverse effects are expected as a result of this project.

### Uncertainty of Benefits

Uncertainties relating to the flood reduction benefits of this project are summarized below in Table 9-7. As shown in the table below, uncertainties regarding flood reduction benefits would occur because additional detailed flood modeling of culvert and slope failures is needed.

**Table 9-7: Omissions, Biases, and Uncertainties and their Effect on the Project**  
***Chollas Creek Integration Project***

Benefit or Cost Category	Likely Impact on Net Benefits	Comment
Avoided Flood Damages	+	Benefit is likely to have a moderate positive benefit on both private (residences) and municipal (culvert and slope) property. Detailed flood modeling to augment the information provided by the FRAM model needs to be performed.

\* Magnitude of effect on net benefits

+/- (negligible or unknown); + (moderate positive); ++ (significant positive); - (moderate negative); -- (significant negative)

## Appendix 9-1: Economic Analysis Tables

### ✓ Project 1: Sustainable Landscapes Program

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 2: North San Diego County Regional Recycled Water Project

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 3: North San Diego County Cooperative Demineralization Project

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 4: Rural Disadvantaged Community (DAC) Partnership Project

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 5: Lake Hodges Water Quality and Quagga Mitigation Measures

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 6: Implementing Nutrient Management in the Santa Margarita River Watershed

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 7: Bannock Avenue Neighborhood Streetscape Enhancements for Tecolote Creek Watershed Protection

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 8: Pilot Concrete Channel Infiltration Project

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 9: San Diego Regional Water Quality Assessment and Outreach Project

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

### ✓ Project 10: Chollas Creek Integration Project

Table 17 – Annual Cost of Project .....	Attached
Table 18 – Flood Event Damage .....	Attached
Table 19 – Present Value of Expected Annual Damage Benefits .....	Attached

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✓ **Project 11: Regional Water Data Management Program**

Table 17 – Annual Cost of Project .....	Not Applicable
Table 18 – Flood Event Damage .....	Not Applicable
Table 19 – Present Value of Expected Annual Damage Benefits .....	Not Applicable

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Table 17 - Annual Cost of Project (All costs should be in 2009 dollars) Project: Chollas Creek Integration Project									
Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Grand Total Cost from Table 7 (row (i), column (d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a)+...+(f)	Discount Factor	Discounted Costs (g) x (h)
2009	\$0	\$0	\$0	\$0	\$0	\$0	\$0	1.00	\$0
2010	\$71,604	\$0	\$0	\$0	\$0	\$0	\$71,604	0.94	\$67,551
2011	\$196,760	\$0	\$0	\$0	\$0	\$0	\$196,760	0.89	\$175,116
2012	\$425,646	\$9,000	\$2,000	\$9,500	\$5,000	\$0	\$451,146	0.84	\$378,791
2013	\$300,490	\$7,200	\$2,000	\$9,000	\$2,500	\$0	\$321,190	0.79	\$254,413
2014	\$0	\$7,200	\$1,000	\$8,000	\$2,500	\$0	\$18,700	0.75	\$13,974
2015	\$0	\$7,200	\$500	\$7,000	\$0	\$0	\$14,700	0.70	\$10,363
2016	\$0	\$7,200	\$0	\$7,000	\$0	\$0	\$14,200	0.67	\$9,444
2017	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.63	\$6,651
2018	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.59	\$6,274
2019	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.56	\$5,919
2020	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.53	\$5,584
2021	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.50	\$5,268
2022	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.47	\$4,970
2023	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.44	\$4,688
2024	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.42	\$4,423
2025	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.39	\$4,173
2026	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.37	\$3,936
2027	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.35	\$3,714
2028	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.33	\$3,503
2029	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.31	\$3,305
2030	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.29	\$3,118
2031	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.28	\$2,942
2032	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.26	\$2,775
2033	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.25	\$2,618
2034	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.23	\$2,470
2035	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.22	\$2,330
2036	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.21	\$2,198
2037	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.20	\$2,074
2038	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.18	\$1,956
2039	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.17	\$1,846
2040	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.16	\$1,741
2041	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.15	\$1,643
2042	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.15	\$1,550
2043	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.14	\$1,462
2044	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.13	\$1,379
2045	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.12	\$1,301
2046	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.12	\$1,227
2047	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.11	\$1,158
2048	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.10	\$1,092
2049	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.10	\$1,031
2050	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.09	\$972
2051	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.09	\$917
2052	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.08	\$865
2053	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.08	\$816
2054	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.07	\$770
2055	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.07	\$727
2056	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.06	\$685
2057	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.06	\$647
2058	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.06	\$610
2059	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.05	\$575
2060	\$0	\$3,600	\$0	\$7,000	\$0	\$0	\$10,600	0.05	\$543
Project Life	Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, Column (c ), Exhibit F: Proposal Costs and Benefit Summaries								\$1,018,096
Comments:									

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**Table 18 - Flood Event Damage (2009 dollars)  
Project: Chollas Creek Integration Project**

(a) Hydrologic Event	(b) Event Probability	(c) Damage if Flood Structures Fail			Probability of Structure Failure (d) Without Project			Probability of Structure Failure (e) With Project			Event Damage		(h) Event Benefit in \$million [f - g]
		Culvert Damage <sup>1</sup>	Slope Damage <sup>2</sup>	Home Damage <sup>3</sup>	Culvert Damage	Slope Damage	Home Damage <sup>4</sup>	Culvert Damage	Slope Damage	Home Damage <sup>4</sup>	(f) Without Project [c x d]	(g) With Project [c x e]	
10-Year	0.100	\$242,640	\$2,075,100	\$0	0.050	0.020	0.000	0.030	0.012	0.000	\$53,634	\$32,180	\$21,454
15-Year	0.067	\$242,640	\$2,075,100	\$300,000	0.100	0.050	1.000	0.060	0.030	0.000	\$428,019	\$76,811	\$351,208
20-Year	0.050	\$242,640	\$2,075,100	\$900,000	0.200	0.100	1.000	0.120	0.060	1.000	\$1,156,038	\$1,053,623	\$102,415
25-Year	0.040	\$242,640	\$2,075,100	\$900,000	0.300	0.150	1.000	0.180	0.090	1.000	\$1,284,057	\$1,130,434	\$153,623
50-Year	0.020	\$242,640	\$2,075,100	\$1,500,000	0.500	0.200	1.000	0.300	0.120	1.000	\$2,036,340	\$1,821,804	\$214,536
<b>TOTAL</b>													<b>\$843,235</b>
<b>Comments:</b> The project will reduce flooding depths and frequencies for properties immediately adjacent to the proposed restoration project as well as for properties immediately upstream of the Restoration Project adjacent to Euclid Avenue. Mainly residential structures will be benefited. In addition, the depth of flooding over Euclid Avenue, and the frequency of overtopping will be reduced as a result of the restoration project, improving public safety in the area. Existing Structures are impacted, however flood depths are reduced by up to 2 feet for structures near Euclid Ave during a 100-year storm, as a direct result of this project. The anticipated discharge over Euclid Ave during a 50-year storm is reduced by approximately 40% as a result of the project.													

1 Rick Engineering. December 21, 2010. Euclid Avenue Culvert Repair.

2 Rick Engineering. December 15, 2010. Chollas Creek Slope Repair.

3 Rick Engineering. December 21, 2010. Existing/Proposed Condition Structure Inundation.

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Table 19 - Present Value of Expected Annual Damage Benefits (2009 dollars)			
Project: Chollas Creek Integration Project			
(a)	Expected Annual Damage Without Project		\$107,359
(b)	Expected Annual Damage With Project		\$88,116
(c)	Expected Annual Damage Benefit	[a - b]	\$19,244
(d)	Present Value Coefficient		15.65
(e)	Present Value of Future Benefits	[c x d]	\$301,165
Comments:			